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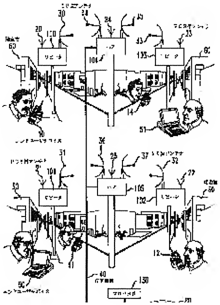
(54) TRANSMISSION SYSTEM, RADIO WAVE COMMUNICATION NETWORK AND COMMUNICATION METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a cost-effective reverse directional transmission system through the use of a single directional millimeter wave antenna with high gain for communication between a PCS band antenna and a PCS hub.
SOLUTION: A PCS network adds micro cell repeaters 100, 101, 102 and 103, micro cell hubs 104, 105, a base station 110 and a fixed network 120. Radio wave telephone sets 10, 11, 12 and 14 and multi-media work stations 50, 51 transmit/receive information with the corresponding PCS band antennas 20-25 between the most adjacent repeaters 100-103 or the hubs 104, 105. The millimeter wave band antennas 30-33 are the ones



such as a parabola antenna, a single directional antenna and a high gain antenna, etc., and form a millimeter wave link between the repeaters 100 and 103 (101 and 102) and the hub 104 (105).

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TECHNICAL FIELD

[Field of the Invention] Especially this invention relates to the approach of connecting the cel and microcell in a radiocommunication network, and its system about the transmitting system for radiocommunication.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] the demand to flexibility which is mentioned above -- in addition, the object which makes potential [in / in the hard flow transmitting system about a PCS network / the commercial scene] satisfy sake -- a PCS product and service -- cost -- it is required to be so economical that considering as an effective thing be possible. therefore, a substantial property-disbursement (expense) required in order that the example concerning the conventional technique of connecting a single PCS microcell (pico cel) antenna to a base station with the fiber optic cable by which termination was carried out by the light wave transceiver which operates with the different wireless interface may lay a fiber optic cable especially in urban environment (or it rents) sake -- cost -- it is not effective. therefore, the cost which offers the advantage of the flexibility from which the trouble concerning the conventional technique became possible by transparent transport of a spectrum block, without needing the cable connection with a base station from each microcell -- it is that the effective hard flow transmitting system is missing.

EFFECT OF THE INVENTION

[Effect of the Invention] the cost which offers the advantage of flexibility which became possible by transparent transport of a spectrum block according to this invention, without needing the cable connection with a base station from each microcell as stated above -- an effective hard flow transmitting system is offered.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the PCS outdoor network which realized the principle of this invention.
[Drawing 2] The block diagram showing the PCS inside-of-a-house network which realized the principle of this invention.
[Drawing 3] The block diagram showing the example of a PCS repeater arranged according to this invention so that it may communicate with a PCS hub.
[Drawing 4] The block diagram of the PCS hub designed through the PCS repeater and millimeter wave link of drawing 3 according to this invention so that it might communicate through a PCS base station, a fiber-optics circuit, or other broadband media.
[Drawing 5] Drawing showing the configuration of the city PCS network example which realized the principle of this invention.
[Description of Notations]
10, 11, 12, 13, 14 End user device
20, 21, 22, 23, 24, 25 PCS band antenna
30, 31, 32, 33, 34, 35, 36, 37 Millimeter wave antenna
40 Transmission Device
50, 51, 52, 53 End user device
60 Building
80 Telephone
90 Transmission Device
100, 101, 102, 103 Repeater
104 105 Hub
110 Base Station
120 Fixed Network
130 Processor
210 LAN Server
220 PBX
301 305 Duplexer
302 Frequency Converter/Amplifier
303 IF Amplifier / FM Discriminator
304 Frequency Conversion
306 Voltage Controlled Oscillator (VCO)
307 IF Amplifier / Mixer
308 Low Noise Amplifier/Frequency Converter
401 Duplexer
402 403 Voltage controlled oscillator
404 405 Facility interface
406 407 IF amplifier / FM discriminator
408 409 Frequency converter

501, 502, 503, 504 Hub
505, 506, 507, 508, 509, 510, 511, 512, 513, 514 Repeater
520 Base Station
530 540 Broadband cable device
550 560 Radio link

MEANS

[Means for Solving the Problem] This invention points to the transmitting system which consisted of two or more repeater clusters. In the system concerned, each repeater in a cluster is connected to the common hub through the corresponding radio link. The radio signal received by the repeater from the end user device is transmitted to transparent (namely, regardless of a wireless interface) by the radio link in the corresponding hub which functions as a signal concentrator about a repeater. The hub is linked by high-speed transmitter styles, such as a fiber optic cable, to a base transceiver station (in the case of setting in the outdoors), a server, or PBX (in the case of an inside-of-a-house environment). This high-speed transmitter style is shared by all the PCS repeaters in a cluster.
[0005] According to the principle of this invention, each PCS repeater offers service to corresponding microcell or a corresponding pico cel, and has the high interest profit for the communication link with the antenna of a PCS band, and a PCS hub, and a unidirectional millimeter wave antenna. The antenna of a PCS band is used in order to provide low power and a portable lightweight device with PCS type service, and on the other hand, high interest profit and a unidirectional millimeter wave antenna are used for the communication link to the PCS hub through the direction propagation path of a look on a millimeter wave wireless circuit. Although a PCS hub can have a PCS antenna for microcell (or pico cel) in itself, it functions as a concentrator of a PCS repeater cluster, and the signal is transmitted to transparent by the millimeter wave radio link.
[0006] In the example concerning the principle of this invention, the communication link to a PCS hub from a PCS repeater is the object which modulates block spectrum (for example, 5MHz frequency band) to a millimeter wave carrier for transmission through a millimeter wave link, and uses analog block frequency modulation (block FM) technique. If it states to a detail, the signal from the PCS end user device received by the PCS repeater will be amplified, and will be changed into a lower intermediate frequency (IF) signal (for example, one to 6 MHz near the baseband). Then, an IF signal is supplied as a modulating signal to the voltage controlled oscillator which is operating on the higher frequency (for example, about 38GHz), in order to carry out the frequency modulation of the carrier for transmission through a millimeter wave radio link to a linear. Or a voltage controlled oscillator operates on a lower frequency, and multiplying of it is carried out to an output frequency. Similarly, the PCS hub is arranged so that the signal received from network devices, such as a base transceiver station, may be changed into a lower IF signal. This IF signal is supplied as a modulating signal to the voltage controlled oscillator which is operating in the different frequency range (for example, 39GHz band). The output signal of a voltage controlled oscillator is transmitted to a suitable repeater through a millimeter wave radio link.
[0007] The communication link to a wireless end user device from a repeater changes into an intermediate frequency signal the millimeter wave signal acquired from the base transceiver station, and in order to amplify it and to acquire after that the signal near the baseband of the PCS signal which should be transmitted (for example, one to 6 MHz), it is realized by performing frequency modulation. Subsequently, frequency conversion of the signal near the baseband is carried out to the PCS carrier frequency of which it is expected, and it is transmitted after power amplification.
[0008]
[Embodiment of the Invention] Drawing 1 is the block diagram showing the PCS outdoor network

example which realized the principle of this invention. The microcell repeaters 100, 101, 102, and 103, the microcell hubs 104 and 105, the base station 110, and the fixed network 120 are included in the PCS network shown in drawing 1 . The microcell repeaters 100, 101, 102, and 103 are installed in the stanchion of the utility pole with a height of 10 meters and a streetlight, or the side face of a building, and function as a PCS network access point for end user devices. In drawing 1 , as for the example of an end user device, radiotelephones 10, 11, 12, and 14 and multimedia workstations 50 and 51 are shown. It is made for them to have information transmitted and received through the PCS band antennas 20, 21, 22, 23, 24, and 25 which correspond between the repeaters 100, 101, 102, and 103 of the maximum contiguity, or hubs 104 and 105. In order to generate the predetermined signal which modulates the millimeter wave signalling frequency transmitted to the microcell hub 104 which corresponds through the corresponding millimeter wave antennas 30, 31, 32, and 33, and addressing to 105, frequency conversion of the information received through the PCS band antennas 20, 21, 22, and 23 is carried out near the baseband from a PCS carrier frequency, as described by the detail below. These millimeter wave band antennas are parabolic-antenna, unidirectional antenna, and high interest profit antennas etc., and in order to form a millimeter wave link between the microcell repeaters 100 and 103 (101 102) and the microcell hub 104 (105), they are the same as the antennas 34/35 (36/37) installed in the microcell hub 104 (105) in the look path (LOS). The thing with the microcell repeaters 100 and 103 (101 and 102) of the microcell hub 104 (105) which may be installed in the stanchion of the utility pole or a streetlight arranged at the crossing of a street for a communication link is best because of the demand about a look path (LOS) (however, it is not indispensable). In the actual implementation of the principle concerning this invention The millimeter wave antennas 30, 31, 32, 33, 34, 35, 36, and 37 it is designed so that it may have opening which has the diameter of 1 foot, and swerve and be alike -- the narrow antenna beam width ****** (ed) It makes it possible to realize sufficient gain, in order to compensate the attenuation caused by atmospheric-air related factors, such as intense rain and ****, and to escape the multi-pass effectiveness caused by the echo from adjoining 63-D from building 60-A.

[0009] Each of the microcell repeaters 100, 101, 102, and 103 which belong to the microcell hub 104 or 105 needs a channel pair with original one per transmit direction on a millimeter wave spectrum. Although these channels are original about the specific link which has connected the repeater and the hub, the frequency concerning those channels can be reused by other links. This is because two links where the ratio (gain) of the main-lobe pair back lobe of the unidirectional millimeter wave antennas 34, 35, 36, and 37 adjoins make it possible to use the same millimeter wave frequency. Furthermore, the separation between channels improves by using the direction of polarization which intersects perpendicularly mutually as described by the detail below.

[0010] Furthermore, the base station 110 connected to the block diagram of drawing 1 through the high-speed intermediary feeder 40 in the microcell hubs 104 and 105 is illustrated. The transmission device 40 may be realized as a fiber optic cable by which termination was carried out by light wave transceivers, such as the AT & T light wave microcell transceiver (LMT). LMT is built so that the received radio frequency (RF) signal may be changed into a lightwave signal transparent by carrying out direct modulation of the laser by the received RF signal. A base station 110 functions as the gateway for a communication link between the fixed network 120 and the wireless network of drawing 1 . The base station 110 consists of the hardware and the software components which

perform call setting out and the switching function concerning the call between the end user devices 10, 11, 12, 14, 50, and 51. The assignment of a radio channel to an active end user device and management, cutting of the connection at the time of call termination, mediation of the hand off of the call to another cel from a certain microcell, etc. are included in call setting out and the switching function of a base station 110. The mobile exchange center (not shown) which realizes a communication path without the joint about the call addressed to a wire telephone machine connected to addressing to a wireless end user device or the fixed network 120 by which routing is carried out through the wireless network of drawing 1 is included in the component which exists simultaneously all over a base station 110. The fixed network 120 is a terrestrial-circuit network where the call origination from a wireless end user communication link device consists of the area and the charged exchange (not shown) which make it possible to receive a message in the cable end user device of telephone 80 grade, and which interconnected. Refer to Gauldin et al., "The 5 ESS Re Wireless Mobile Switching Center", and AT & T Technical Journal, Volume 72, No.4 and July/August 1993 about the related connection with a mobile exchange center and a wireless network.

[0011] In drawing 1 , although the base station 110 is connected to hubs 104 and 105 through the cable device 40, hubs 104 and 105 should care about that it is also possible to connect with a base station 110 through a corresponding radio link. Similarly, it is also possible to be located in the location as one side of hubs 104 and 105 where a base station 110 is the same.

[0012] Drawing 2 is the block diagram showing the PCS inside-of-a-house network which realized the principle of this invention. The pico cel repeater 100-101 located in the direction of a look of the pico cel hubs 104 and 105, respectively and 102-103 exist in the PCS network shown in drawing 2 , and the pico cel hubs 104 and 105 are connected to the LAN server 210 and PBX220 through the transfer device 90 by the cable or the optical fiber. The pico cel repeaters 101-103 are embedded on the head lining, and the communication path by which it is not interrupted between these repeaters, the end user radiocommunication device 10-13, and 50-53 is realized. The end user communication link device 50-53 is realized as the portable processor equipped with the network interface adapter, the integration RF modem, the PCS wireless transceiver, and the suitable PCS antenna, or a notebook computer. Or the wireless end user device 50-53 is the personal multimedia terminal equipped with the wireless network interface adapter which followed a well-known standard [for the personal computer memory card League of Nations (PCMCIA)] one, for example.

[0013] Although repeaters 100-103 have all the descriptions described about the outdoor network environment of drawing 1 , in the inside-of-a-house environment, the points of operating on the different frequency which was different from each other for every application differ. for example, the repeater 100-103 -- the wireless end user device 50-53 -- direct sequence (or frequency hopping) spread-spectrum technique [in / for turning / the both sides of the ISM band of 900MHz, 2.45GHz, or a higher frequency] is used. Or a repeater 100-103 is Motorola Altair. In the 18GHz frequency used with a WLAN product of a certain kind, such as WLAN, a RF signal (addressing to the wireless end user device 50-53) is emitted. Similarly, use the communication link between a repeater 100-103 and a radiotelephone 10-13 as the pan depending on each application in another frequency. For example, when PBX220 or the LAN server 210 is the multimedia communication device which provides a multimedia end user device with service, a repeater 100-103 operates in a frequency higher than the case where the LAN server 210 and PBX220 are single media communication link devices.

[0014] A repeater 100-103 communicates with the corresponding hub 104-105 irrespective of the clock frequency through the direction millimeter wave circuit of a look which operates with a suitable transmitting output (less than 100mW) on a frequency higher than about 38GHz or it. Even when a traffic demand grows, as for the repeater shown in drawing 2 , it is advantageous that a re-configuration does not have to be carried out.
[0015] Drawing 3 is a block diagram which has been arranged according to this invention and in which showing the example of the repeater which transmits and receives a signal between a hub and the both sides of a wireless end user device. The millimeter wave antenna 30 connected to the PCS band antenna 20 connected to the duplexer 301 and the duplexer 305 is contained in the repeater shown in drawing 3 . Furthermore, the frequency converters 302 and 308, the intermediate frequency amplifier/mixers 303 and 307, and the source 306 of a frequency modulation possible millimeter wave are included in drawing 3 . An antenna 30 is a high interest profit millimeter wave unidirectional antenna, and is arranged in the direction of a branch line of a hub 104. An antenna 30 is a parabola reflector which has the diameter of 1 foot, and is used for the both sides of signal transmission and signal reception. Therefore, a duplexer 305 is used in order to separate the received signal and the signal transmitted by the repeater of drawing 3 . The frequency difference between an input signal and a sending signal must be appropriately chosen so that the good duplexer engine performance can be realized at suitable cost. Similarly, a duplexer 301 is used in order to separate the PCS signal sent out to an end user device by the repeater of drawing 3 , and the PCS signal from these end user devices received by the repeater of drawing 3 .
[0016] If the repeater of drawing 3 receives the millimeter wave signal by which frequency modulation was carried out from one side of a hub 104-105, the received signal will be sent to a frequency converter 304 with a duplexer 305, and a frequency converter 304 will carry out the down convert of the millimeter wave signal at the intermediate frequency (IF) of UHF or microwave within the limits. Or in order to improve a noise figure, a low noise amplifier is prefaced in front of a frequency converter. Then, this IF signal is transmitted to IF amplifier and the FM discriminator 303. It has in IF amplifier and the FM discriminator 303, FM signal discriminator, i.e., the detector, which restores to the amplifier arranged so that the gain element usually comparatively weak after frequency conversion of the IF signals of which a reception was done may be increased, and the IF signal carrier of bFM base, for example, exists in the frequency range of one to 6 MHz and which recovers the version near the baseband of a PCS signal. FM signal discriminator, i.e., a detector, -- a UHF frequency range -- setting -- for example, the product made from Plessey -- it realizes using chip SL-1455. Thus, the generated signal near the PCS baseband is amplified by the frequency converter 302, and frequency conversion is carried out to a predetermined PCS carrier frequency, and it is sent to the duplexer 301 which separates the received PCS signal and the PCS signal transmitted. Being made in two or more steps, by the time frequency conversion mentioned above reaches a predetermined frequency should also care about a certain thing. For example, it is mixed so that an intermediate frequency signal may be generated first, and subsequently, the signal near the baseband outputted from IF amplifier / FM discriminator 303 is again mixed so that for example, a 900MHz signal may be generated.
[0017] If the repeater of drawing 3 receives a PCS signal from an end user wireless device through an antenna 20, the received PCS signal will be sent to a low noise amplifier (LNA) 308 with a duplexer

301, in order to make the noise figure of the repeater of drawing 3 good. The received PCS signal is the PCS spectrum block of for example, 5MHz width of face, and frequency conversion is carried out to the PCS signal of the version near the baseband of a frequency range called one to 6 MHz by the combination of LNA / frequency converter 308, and the IF amplifier / mixer 307. The signal acquired as a result is supplied to the voltage controlled oscillator (VCO) which carries out the frequency modulation of the carrier with the signal, and predetermined millimeter wave signalling frequency is generated. The generated millimeter wave signal is sent to the direct duplexer 305 and the millimeter wave antenna 30.

[0018] The signal outputted by VCO306 is located in a 38GHz field in the example concerning the principle of this invention. Selection of this millimeter wave frequency is determined by the path parameter of a link. The frequency of about 38GHz is desirable from the point of path attenuation according to rain about outdoor application. If related with inside-of-a-house application, the higher millimeter wave frequency is more suitable. About the actual implementation of the principle of this invention, pre-emphasis of the modulating signal in the port of VCO36 should be carried out. If it states to a detail, when the repeater of drawing 3 will have transmitted to the hub 104, it is applied before the signal carries out the frequency modulation of VCO306 to the signal of the injury 1with weight-6MHz field according to f2. Similarly, when the repeater of drawing 3 has received the signal from a hub 104, injury application with weight of 1/f2 is carried out to IF amplifier / FM discriminator 303.

[0019] Drawing 4 is the block diagram showing the example of the hub designed according to this invention which communicates with the repeater of drawing 3 through a millimeter wave link. The hardware component as what was used also in repeaters of drawing 3 , such as a millimeter wave antenna (this example antenna 34) used about the both sides of reception of a signal and transmission, with the same hub of drawing 4 is used. However, in a hub 104, the design of a duplexer 401 is more complicated. It is because two or more repeaters provided with service by the same millimeter wave antenna may exist. A hub 104 communicates with two repeaters using the direction of polarization (for example, a horizontal direction and a perpendicular direction) which intersects perpendicularly in this example. By using the direction of polarization which intersects perpendicularly, it becomes possible to combine two signals by no losing substantially, or to dissociate. Therefore, while a duplexer 401 is a duplexer concerning the frequency which separates a transceiver signal, it is also a duplexer applied in the direction of polarization which separates the signal transmitted and received between two different microcell repeaters. Furthermore, the signal from two different repeaters can be respectively transmitted in the different corresponding frequency, and it is also possible to realize the method using the direction of polarization single in addition to the method using the two directions of polarization.

[0020] Only the minimum processing is needed about the signal received in the hub 104 from one side of repeaters 100 and 103, and the signal sent out to a common-network backbone device (device 90 shown in the device 40 shown in drawing 1 , and drawing 2). Although these signals are for example, 38GHzFM modulating signals, the down convert of them is carried out by the frequency converter 408 (409) at the different intermediate frequency located for example, in a 500MHz field. Since the gain element of a frequency converter 408 (409) is comparatively weak, the signal near the baseband which gets over by frequency discriminator (discriminator) and is located in a 1-6MHz field

after an IF signal is beforehand amplified in the IF amplifier 406 (407) is recovered. When the facility interface 405 is a fiber interface, the signal near the baseband may be used in order to carry out linear modulation of the solid state laser contained in an interface 405. The center frequency of each signal is chosen so that the frequency of all the Miyoshi intermodulation products may go into the frequency range where the spectrum of a signal does not exist. By applying this technique to a multi-channel analog fiber transmission system, the demand concerning the linearity (linearity) over a fiber style is reduced.

[0021] One of the advantages of this arrangement when an optical-fiber-transmission device is used is that the intermodulation product of the signal transmitted by the fiber style is avoided. It is because signal frequency can be chosen so that the wide band which an optical-fiber style usually has may be utilized by controlling frequency arrangement of each signal. The fault of needing the total band larger than the case where a channel is stuffed as much as possible also exists in this method. Therefore, a band is in the relation between linearity and a trade-off. A fiber interface is realized using for example, the AT & T light wave microcell transceiver or its imitation.

[0022] The facility interface 404 arranged so that the signal near the baseband of one to 6 MHz may be received through a device 40 (or 90) from the base station 110 (or PBX [220] or LAN210 of drawing 2) of drawing 1 is also shown in drawing 4 . In that it is not necessary to fill the demand which relates to linearity strictly, when implemented as a fiber interface, the facility interfaces 404 differ in the facility interface 405. It is because the dynamic range of the signal which should be transmitted is quite small. It restores to the signal received in the facility interface 404, and the signal of a 1-6MHz field is recovered, the recovered signal is impressed to one of the voltage controlled oscillator (VCO) 402 which carries out the frequency modulation of the signal to a carrier, or 403, and predetermined millimeter wave signalling frequency is generated. Millimeter wave signalling frequency is sent to the direct duplexer 401 and the millimeter wave antenna 34. In a certain kind of example, before modulating VCO402 or 403, it is desirable to amplify the signal near the baseband received from the facility interface 404, and to carry out a rise convert.

[0023] Another, important example of the facility interfaces 404 and 405 is a "digital solution." This includes the phase which carries out the multiplexer of Digital Stream to a fiber using the phase and the standard digital interface which digitize an analog signal using a high-speed analogue-to-digital (A/D) converter. Notionally, this method looks more complicated than an analog solution. It is because the total bit rate depending on an implementation exceeds 1G/s bit in many cases. However, this method has the "standard" advantage which sends out an analog signal through a fiber that it is a method.

[0024] Drawing 5 shows the plan of the city PCS network example which realized the principle of this invention. The hubs 501, 502, 503, and 504 arranged at the crossing of the street called an "avenue" and a "street" are shown in the PCS network of drawing 5 . Two or more repeaters related within an about 1km radius of each hub are arranged, and it is in the look path of each hub, respectively. For example, the hub 501 relates to repeaters 505, 506, 507, 508, and 509. Similarly, the hub 503 is connected with the repeater 510 by wireless, and hubs 504 and 502 reach repeater 512-514, respectively, and provide 511 with service. Hubs 501, 502, 503, and 504 are bearing the both sides of a role of a repeater to the mobile end user device which transmits aPCS signal, and a role of a concentrator concerning the related repeater to the b base station 520 which transmits traffic for

transmission. Although each repeater is located in the look path of a related hub in drawing 5 , the repeater itself should care about that it does not need to be mutually located in the look path of the base station 520 which provides each repeater with service. The base station 520 is connected to hubs 501 and 503 through the broadband cable devices 530 and 540, such as an optical fiber or a coaxial cable. On the other hand, hubs 502 and 504 are connected to the base station 520 through radio links 550 and 560, respectively. When radio links 550 and 560 function on a millimeter wave frequency, hubs 502 and 504 must be located in the look path of a base station 520.

[0025] Each repeater shown in the example of a PCS communication network of drawing 5 realizes radiocommunication to the low power mobile end user device in the field which a related cel site covers. Each repeater is equipped with the antenna installed in the about 10-meter high for the low power nature of propagation loss and a mobile end user device. These are fully lower than the roof of the building of the perimeter square [in drawing 5] and shown. The field which each cel site covers is restricted by this. Since the field covered by each cel is restricted, in order to cover the whole region everywhere, connection with the base station relevant to the repeater of very many numbers is needed. The capital expenditure needed about this kind of infrastructure is rather difficult for the installation term of PCS service. Probably, the number of PCS subscribers will be unnecessary since it is expected that they are not a large number so much at a service installation stage. [of presenting each cel site / repeater with a network function]

[0026] According to another side face of this invention, two or more repeaters (hereafter called "the repeater in a cluster") in relation to a single hub may be arranged so that it may both function by the "simulcast" method. If it states to a detail and a mobile end user device will transmit a PCS signal, all the repeaters that receive the PCS signal in a cluster will transmit the same PCS signal (or deformation bar SHON of a certain kind) to the hub where it is related through a corresponding radio link (in a cluster). In addition to receiving each bar SHON of a PCS signal from the repeater in a cluster, also in itself [hub], a PCS signal is received from a mobile (setting with role of repeater) end user device. Then, a hub is only added to the PCS signal with which the hub itself received each bar SHON of a common PCS signal (for example, straight-line adder), generates a single combination signal, and sends it out to a base station 520. Or a hub sends out each bar SHON (what the hub itself received is included) of a PCS signal to a base station 520, and performs signal add operation in which the base station 520 was mentioned above. As for the repeater in which it was [in the cluster] different from each other, the case of both sides functions as parts with which the distributed antenna was different from each other. (from a hub to an end user device) About the communication link of hard flow, a hub will broadcast each signal transmission which received from the base station 520 to all addressing to a repeater in a cluster. The advantage of using simulcast is that the fiber interface in a hub becomes brief. It is because only the signal of one ** needs to arrive at a hub through a fiber. Frequency conversion of the signal which similarly is received by the repeater within the same cluster is carried out to the same frequency as the inside of a hub, it is possible to be mutually added before sending out through a fiber as mentioned above, and the band demand concerning a fiber is reduced. The further advantage of using simulcast is not performing a hand off, when a mobile end user moves between two cels in the same cluster. Still more nearly another advantage of using simulcast is that the range which PCS covers offers the innovative solution about the field where traffic is low in this time which makes it possible to be extended at the expense of min by using the transfer

infrastructure by which a reuse may be carried out when a traffic demand increases and network capacity must come to be occupied about the cel site according to individual .
[0027] Although the various modifications of this invention can consider the above explanation about one example of this invention if it is this contractor of this technical field, each of they is included by the technical range of this invention.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the approach of connecting the cel and microcell in a radiocommunication network, and its system about the transmitting system for radiocommunication.
[0002]
[Description of the Prior Art] It is expected that a Personal Communication Service (PCS) technique brings a revolution to communication link industry. because, low [which is carried by the mobile user in broadband data utility] -- it is because it has the potential of providing for a power portable lightweight device. However, some failures of delaying realization of this potential exist. For example, a PCS technique is developing so that the multi-dimension communication link framework which unified the extensive mobile communication system covering cellular type PCS and cordless type PCS from the wireless private branch exchange (WPBX) and a wireless Local Area Network (WLAN) may be included. namely, it is provided under the PCS influence -- it is -- it is -- while the system and service which are considered [being provided and] are functioning in the different frequency spectrum, for example, WPBX which is a 902-908MHz frequency band is functioning, another WPBX is designed for Europe cordless criteria. Similarly, although a certain WLAN vendor (AT & T GIS), for example, NCR, offers the wireless hubs (WaveLAN etc.) which operate on a 902 to 928 MHz frequency, other vendors, such as Motorola (Motrola), offer the lineup (for example, Altair) of a WLAN product by the so-called wireless in building (WIN) criterion which functions by 18GHz. When the single criterion concerning a PCS product and service defined exactly is missing, the patch of the PCS product which is not compatible, or service will be brought forth, and it will become impossible to offer the communication link without the joint to other things [service / a certain / product or service]. A certain PCS network design is based on the specific criterion, and this problem is further complicated by the data of not functioning, under other PCS network designs which have realized the different criterion. The PCS system which has the transmitting system which may be used to the wireless interface which was different from each other, without having enabled transparent (****) spectrum transport clearly and the same hardware correcting is desirable.
[0003]
[Problem(s) to be Solved by the Invention] the demand to flexibility which is mentioned above -- in addition, the object which makes potential [in / in the hard flow transmitting system about a PCS network / the commercial scene] satisfy sake -- a PCS product and service -- cost -- it is required to be

so economical that considering as an effective thing be possible. therefore, a substantial property-disbursement (expense) required in order that the example concerning the conventional technique of connecting a single PCS microcell (pico cel) antenna to a base station with the fiber optic cable by which termination was carried out by the light wave transceiver which operates with the different wireless interface may lay a fiber optic cable especially in urban environment (or it rents) sake -- cost -- it is not effective. therefore, the cost which offers the advantage of the flexibility from which the trouble concerning the conventional technique became possible by transparent transport of a spectrum block, without needing the cable connection with a base station from each microcell -- it is that the effective hard flow transmitting system is missing.

[0004]

[Means for Solving the Problem] This invention points to the transmitting system which consisted of two or more repeater clusters. In the system concerned, each repeater in a cluster is connected to the common hub through the corresponding radio link. The radio signal received by the repeater from the end user device is transmitted to transparent (namely, regardless of a wireless interface) by the radio link in the corresponding hub which functions as a signal concentrator about a repeater. The hub is linked by high-speed transmitter styles, such as a fiber optic cable, to a base transceiver station (in the case of setting in the outdoors), a server, or PBX (in the case of an inside-of-a-house environment). This high-speed transmitter style is shared by all the PCS repeaters in a cluster.

[0005] According to the principle of this invention, each PCS repeater offers service to corresponding microcell or a corresponding pico cel, and has the high interest profit for the communication link with the antenna of a PCS band, and a PCS hub, and a unidirectional millimeter wave antenna. The antenna of a PCS band is used in order to provide low power and a portable lightweight device with PCS type service, and on the other hand, high interest profit and a unidirectional millimeter wave antenna are used for the communication link to the PCS hub through the direction propagation path of a look on a millimeter wave wireless circuit. Although a PCS hub can have a PCS antenna for microcell (or pico cel) in itself, it functions as a concentrator of a PCS repeater cluster, and the signal is transmitted to transparent by the millimeter wave radio link.

[0006] In the example concerning the principle of this invention, the communication link to a PCS hub from a PCS repeater is the object which modulates block spectrum (for example, 5MHz frequency band) to a millimeter wave carrier for transmission through a millimeter wave link, and uses analog block frequency modulation (block FM) technique. If it states to a detail, the signal from the PCS end user device received by the PCS repeater will be amplified, and will be changed into a lower intermediate frequency (IF) signal (for example, one to 6 MHz near the baseband). Then, an IF signal is supplied as a modulating signal to the voltage controlled oscillator which is operating on the higher frequency (for example, about 38GHz), in order to carry out the frequency modulation of the carrier for transmission through a millimeter wave radio link to a linear. Or a voltage controlled oscillator operates on a lower frequency, and multiplying of it is carried out to an output frequency. Similarly, the PCS hub is arranged so that the signal received from network devices, such as a base transceiver station, may be changed into a lower IF signal. This IF signal is supplied as a modulating signal to the voltage controlled oscillator which is operating in the different frequency range (for example, 39GHz band). The output signal of a voltage controlled oscillator is transmitted to a suitable repeater through a millimeter wave radio link.

[0007] The communication link to a wireless end user device from a repeater changes into an intermediate frequency signal the millimeter wave signal acquired from the base transceiver station, and in order to amplify it and to acquire after that the signal near the baseband of the PCS signal which should be transmitted (for example, one to 6 MHz), it is realized by performing frequency modulation. Subsequently, frequency conversion of the signal near the baseband is carried out to the PCS carrier frequency of which it is expected, and it is transmitted after power amplification.
[0008]
[Embodiment of the Invention] Drawing 1 is the block diagram showing the PCS outdoor network example which realized the principle of this invention. The microcell repeaters 100, 101, 102, and 103, the microcell hubs 104 and 105, the base station 110, and the fixed network 120 are included in the PCS network shown in drawing 1 . The microcell repeaters 100, 101, 102, and 103 are installed in the stanchion of the utility pole with a height of 10 meters and a streetlight, or the side face of a building, and function as a PCS network access point for end user devices. In drawing 1 , as for the example of an end user device, radiotelephones 10, 11, 12, and 14 and multimedia workstations 50 and 51 are shown. It is made for them to have information transmitted and received through the PCS band antennas 20, 21, 22, 23, 24, and 25 which correspond between the repeaters 100, 101, 102, and 103 of the maximum contiguity, or hubs 104 and 105. In order to generate the predetermined signal which modulates the millimeter wave signalling frequency transmitted to the microcell hub 104 which corresponds through the corresponding millimeter wave antennas 30, 31, 32, and 33, and addressing to 105, frequency conversion of the information received through the PCS band antennas 20, 21, 22, and 23 is carried out near the baseband from a PCS carrier frequency, as described by the detail below. These millimeter wave band antennas are parabolic-antenna, unidirectional antenna, and high interest profit antennas etc., and in order to form a millimeter wave link between the microcell repeaters 100 and 103 (101 102) and the microcell hub 104 (105), they are the same as the antennas 34/35 (36/37) installed in the microcell hub 104 (105) in the look path (LOS). The thing with the microcell repeaters 100 and 103 (101 and 102) of the microcell hub 104 (105) which may be installed in the stanchion of the utility pole or a streetlight arranged at the crossing of a street for a communication link is best because of the demand about a look path (LOS) (however, it is not indispensable). In the actual implementation of the principle concerning this invention The millimeter wave antennas 30, 31, 32, 33, 34, 35, 36, and 37 it is designed so that it may have opening which has the diameter of 1 foot, and swerve and be alike -- the narrow antenna beam width ****** (ed) It makes it possible to realize sufficient gain, in order to compensate the attenuation caused by atmospheric-air related factors, such as intense rain and ****, and to escape the multi-pass effectiveness caused by the echo from adjoining 63-D from building 60-A.
[0009] Each of the microcell repeaters 100, 101, 102, and 103 which belong to the microcell hub 104 or 105 needs a channel pair with original one per transmit direction on a millimeter wave spectrum. Although these channels are original about the specific link which has connected the repeater and the hub, the frequency concerning those channels can be reused by other links. This is because two links where the ratio (gain) of the main-lobe pair back lobe of the unidirectional millimeter wave antennas 34, 35, 36, and 37 adjoins make it possible to use the same millimeter wave frequency. Furthermore, the separation between channels improves by using the direction of polarization which intersects perpendicularly mutually as described by the detail below.

[0010] Furthermore, the base station 110 connected to the block diagram of drawing 1 through the high-speed intermediary feeder 40 in the microcell hubs 104 and 105 is illustrated. The transmission device 40 may be realized as a fiber optic cable by which termination was carried out by light wave transceivers, such as the AT & T light wave microcell transceiver (LMT). LMT is built so that the received radio frequency (RF) signal may be changed into a lightwave signal transparent by carrying out direct modulation of the laser by the received RF signal. A base station 110 functions as the gateway for a communication link between the fixed network 120 and the wireless network of drawing 1 . The base station 110 consists of the hardware and the software components which perform call setting out and the switching function concerning the call between the end user devices 10, 11, 12, 14, 50, and 51. The assignment of a radio channel to an active end user device and management, cutting of the connection at the time of call termination, mediation of the hand off of the call to another cel from a certain microcell, etc. are included in call setting out and the switching function of a base station 110. The mobile exchange center (not shown) which realizes a communication path without the joint about the call addressed to a wire telephone machine connected to addressing to a wireless end user device or the fixed network 120 by which routing is carried out through the wireless network of drawing 1 is included in the component which exists simultaneously all over a base station 110. The fixed network 120 is a terrestrial-circuit network where the call origination from a wireless end user communication link device consists of the area and the charged exchange (not shown) which make it possible to receive a message in the cable end user device of telephone 80 grade, and which interconnected. Refer to Gauldin et al., "The 5 ESS Re Wireless Mobile Switching Center", and AT & T Technical Journal, Volume 72, No.4 and July/August 1993 about the related connection with a mobile exchange center and a wireless network.
[0011] In drawing 1 , although the base station 110 is connected to hubs 104 and 105 through the cable device 40, hubs 104 and 105 should care about that it is also possible to connect with a base station 110 through a corresponding radio link. Similarly, it is also possible to be located in the location as one side of hubs 104 and 105 where a base station 110 is the same.
[0012] Drawing 2 is the block diagram showing the PCS inside-of-a-house network which realized the principle of this invention. The pico cel repeater 100-101 located in the direction of a look of the pico cel hubs 104 and 105, respectively and 102-103 exist in the PCS network shown in drawing 2 , and the pico cel hubs 104 and 105 are connected to the LAN server 210 and PBX220 through the transfer device 90 by the cable or the optical fiber. The pico cel repeaters 101-103 are embedded on the head lining, and the communication path by which it is not interrupted between these repeaters, the end user radiocommunication device 10-13, and 50-53 is realized. The end user communication link device 50-53 is realized as the portable processor equipped with the network interface adapter, the integration RF modem, the PCS wireless transceiver, and the suitable PCS antenna, or a notebook computer. Or the wireless end user device 50-53 is the personal multimedia terminal equipped with the wireless network interface adapter which followed a well-known standard [for the personal computer memory card League of Nations (PCMCIA)] one, for example.
[0013] Although repeaters 100-103 have all the descriptions described about the outdoor network environment of drawing 1 , in the inside-of-a-house environment, the points of operating on the different frequency which was different from each other for every application differ. for example, the repeater 100-103 -- the wireless end user device 50-53 -- direct sequence (or frequency hopping)

spread-spectrum technique [in / for turning / the both sides of the ISM band of 900MHz, 2.45GHz, or a higher frequency] is used. Or a repeater 100-103 is Motorola Altair. In the 18GHz frequency used with a WLAN product of a certain kind, such as WLAN, a RF signal (addressing to the wireless end user device 50-53) is emitted. Similarly, use the communication link between a repeater 100-103 and a radiotelephone 10-13 as the pan depending on each application in another frequency. For example, when PBX220 or the LAN server 210 is the multimedia communication device which provides a multimedia end user device with service, a repeater 100-103 operates in a frequency higher than the case where the LAN server 210 and PBX220 are single media communication link devices.
[0014] A repeater 100-103 communicates with the corresponding hub 104-105 irrespective of the clock frequency through the direction millimeter wave circuit of a look which operates with a suitable transmitting output (less than 100mW) on a frequency higher than about 38GHz or it. Even when a traffic demand grows, as for the repeater shown in drawing 2 , it is advantageous that a re-configuration does not have to be carried out.
[0015] Drawing 3 is a block diagram which has been arranged according to this invention and in which showing the example of the repeater which transmits and receives a signal between a hub and the both sides of a wireless end user device. The millimeter wave antenna 30 connected to the PCS band antenna 20 connected to the duplexer 301 and the duplexer 305 is contained in the repeater shown in drawing 3 . Furthermore, the frequency converters 302 and 308, the intermediate frequency amplifier/mixers 303 and 307, and the source 306 of a frequency modulation possible millimeter wave are included in drawing 3 . An antenna 30 is a high interest profit millimeter wave unidirectional antenna, and is arranged in the direction of a branch line of a hub 104. An antenna 30 is a parabola reflector which has the diameter of 1 foot, and is used for the both sides of signal transmission and signal reception. Therefore, a duplexer 305 is used in order to separate the received signal and the signal transmitted by the repeater of drawing 3 . The frequency difference between an input signal and a sending signal must be appropriately chosen so that the good duplexer engine performance can be realized at suitable cost. Similarly, a duplexer 301 is used in order to separate the PCS signal sent out to an end user device by the repeater of drawing 3 , and the PCS signal from these end user devices received by the repeater of drawing 3 .
[0016] If the repeater of drawing 3 receives the millimeter wave signal by which frequency modulation was carried out from one side of a hub 104-105, the received signal will be sent to a frequency converter 304 with a duplexer 305, and a frequency converter 304 will carry out the down convert of the millimeter wave signal at the intermediate frequency (IF) of UHF or microwave within the limits. Or in order to improve a noise figure, a low noise amplifier is prefaced in front of a frequency converter. Then, this IF signal is transmitted to IF amplifier and the FM discriminator 303. It has in IF amplifier and the FM discriminator 303, FM signal discriminator, i.e., the detector, which restores to the amplifier arranged so that the gain element usually comparatively weak after frequency conversion of the IF signals of which a reception was done may be increased, and the IF signal carrier of bFM base, for example, exists in the frequency range of one to 6 MHz and which recovers the version near the baseband of a PCS signal. FM signal discriminator, i.e., a detector, -- a UHF frequency range -- setting -- for example, the product made from Plessey -- it realizes using chip SL-1455. Thus, the generated signal near the PCS baseband is amplified by the frequency converter 302, and frequency conversion is carried out to a predetermined PCS carrier frequency, and it is sent

to the duplexer 301 which separates the received PCS signal and the PCS signal transmitted. Being made in two or more steps, by the time frequency conversion mentioned above reaches a predetermined frequency should also care about a certain thing. For example, it is mixed so that an intermediate frequency signal may be generated first, and subsequently, the signal near the baseband outputted from IF amplifier / FM discriminator 303 is again mixed so that for example, a 900MHz signal may be generated.

[0017] If the repeater of drawing 3 receives a PCS signal from an end user wireless device through an antenna 20, the received PCS signal will be sent to a low noise amplifier (LNA) 308 with a duplexer 301, in order to make the noise figure of the repeater of drawing 3 good. The received PCS signal is the PCS spectrum block of for example, 5MHz width of face, and frequency conversion is carried out to the PCS signal of the version near the baseband of a frequency range called one to 6 MHz by the combination of LNA / frequency converter 308, and the IF amplifier / mixer 307. The signal acquired as a result is supplied to the voltage controlled oscillator (VCO) which carries out the frequency modulation of the carrier with the signal, and predetermined millimeter wave signalling frequency is generated. The generated millimeter wave signal is sent to the direct duplexer 305 and the millimeter wave antenna 30.

[0018] The signal outputted by VCO306 is located in a 38GHz field in the example concerning the principle of this invention. Selection of this millimeter wave frequency is determined by the path parameter of a link. The frequency of about 38GHz is desirable from the point of path attenuation according to rain about outdoor application. If related with inside-of-a-house application, the higher millimeter wave frequency is more suitable. About the actual implementation of the principle of this invention, pre-emphasis of the modulating signal in the port of VCO36 should be carried out. If it states to a detail, when the repeater of drawing 3 will have transmitted to the hub 104, it is applied before the signal carries out the frequency modulation of VCO306 to the signal of the injury 1with weight-6MHz field according to f2. Similarly, when the repeater of drawing 3 has received the signal from a hub 104, injury application with weight of 1/f2 is carried out to IF amplifier / FM discriminator 303.

[0019] Drawing 4 is the block diagram showing the example of the hub designed according to this invention which communicates with the repeater of drawing 3 through a millimeter wave link. The hardware component as what was used also in repeaters of drawing 3 , such as a millimeter wave antenna (this example antenna 34) used about the both sides of reception of a signal and transmission, with the same hub of drawing 4 is used. However, in a hub 104, the design of a duplexer 401 is more complicated. It is because two or more repeaters provided with service by the same millimeter wave antenna may exist. A hub 104 communicates with two repeaters using the direction of polarization (for example, a horizontal direction and a perpendicular direction) which intersects perpendicularly in this example. By using the direction of polarization which intersects perpendicularly, it becomes possible to combine two signals by no losing substantially, or to dissociate. Therefore, while a duplexer 401 is a duplexer concerning the frequency which separates a transceiver signal, it is also a duplexer applied in the direction of polarization which separates the signal transmitted and received between two different microcell repeaters. Furthermore, the signal from two different repeaters can be respectively transmitted in the different corresponding frequency, and it is also possible to realize the method using the direction of polarization single in

addition to the method using the two directions of polarization.
[0020] Only the minimum processing is needed about the signal received in the hub 104 from one side of repeaters 100 and 103, and the signal sent out to a common-network backbone device (device 90 shown in the device 40 shown in drawing 1 , and drawing 2). Although these signals are for example, 38GHzFM modulating signals, the down convert of them is carried out by the frequency converter 408 (409) at the different intermediate frequency located for example, in a 500MHz field. Since the gain element of a frequency converter 408 (409) is comparatively weak, the signal near the baseband which gets over by frequency discriminator (discriminator) and is located in a 1-6MHz field after an IF signal is beforehand amplified in the IF amplifier 406 (407) is recovered. When the facility interface 405 is a fiber interface, the signal near the baseband may be used in order to carry out linear modulation of the solid state laser contained in an interface 405. The center frequency of each signal is chosen so that the frequency of all the Miyoshi intermodulation products may go into the frequency range where the spectrum of a signal does not exist. By applying this technique to a multi-channel analog fiber transmission system, the demand concerning the linearity (linearity) over a fiber style is reduced.
[0021] One of the advantages of this arrangement when an optical-fiber-transmission device is used is that the intermodulation product of the signal transmitted by the fiber style is avoided. It is because signal frequency can be chosen so that the wide band which an optical-fiber style usually has may be utilized by controlling frequency arrangement of each signal. The fault of needing the total band larger than the case where a channel is stuffed as much as possible also exists in this method. Therefore, a band is in the relation between linearity and a trade-off. A fiber interface is realized using for example, the AT & T light wave microcell transceiver or its imitation.
[0022] The facility interface 404 arranged so that the signal near the baseband of one to 6 MHz may be received through a device 40 (or 90) from the base station 110 (or PBX [220] or LAN210 of drawing 2) of drawing 1 is also shown in drawing 4 . In that it is not necessary to fill the demand which relates to linearity strictly, when implemented as a fiber interface, the facility interfaces 404 differ in the facility interface 405. It is because the dynamic range of the signal which should be transmitted is quite small. It restores to the signal received in the facility interface 404, and the signal of a 1-6MHz field is recovered, the recovered signal is impressed to one of the voltage controlled oscillator (VCO) 402 which carries out the frequency modulation of the signal to a carrier, or 403, and predetermined millimeter wave signalling frequency is generated. Millimeter wave signalling frequency is sent to the direct duplexer 401 and the millimeter wave antenna 34. In a certain kind of example, before modulating VCO402 or 403, it is desirable to amplify the signal near the baseband received from the facility interface 404, and to carry out a rise convert.
[0023] Another, important example of the facility interfaces 404 and 405 is a "digital solution." This includes the phase which carries out the multiplexer of Digital Stream to a fiber using the phase and the standard digital interface which digitize an analog signal using a high-speed analogue-to-digital (A/D) converter. Notionally, this method looks more complicated than an analog solution. It is because the total bit rate depending on an implementation exceeds 1G/s bit in many cases. However, this method has the "standard" advantage which sends out an analog signal through a fiber that it is a method.
[0024] Drawing 5 shows the plan of the city PCS network example which realized the principle of this

invention. The hubs 501, 502, 503, and 504 arranged at the crossing of the street called an "avenue" and a "street" are shown in the PCS network of drawing 5 . Two or more repeaters related within an about 1km radius of each hub are arranged, and it is in the look path of each hub, respectively. For example, the hub 501 relates to repeaters 505, 506, 507, 508, and 509. Similarly, the hub 503 is connected with the repeater 510 by wireless, and hubs 504 and 502 reach repeater 512-514, respectively, and provide 511 with service. Hubs 501, 502, 503, and 504 are bearing the both sides of a role of a repeater to the mobile end user device which transmits aPCS signal, and a role of a concentrator concerning the related repeater to the b base station 520 which transmits traffic for transmission. Although each repeater is located in the look path of a related hub in drawing 5 , the repeater itself should care about that it does not need to be mutually located in the look path of the base station 520 which provides each repeater with service. The base station 520 is connected to hubs 501 and 503 through the broadband cable devices 530 and 540, such as an optical fiber or a coaxial cable. On the other hand, hubs 502 and 504 are connected to the base station 520 through radio links 550 and 560, respectively. When radio links 550 and 560 function on a millimeter wave frequency, hubs 502 and 504 must be located in the look path of a base station 520.

[0025] Each repeater shown in the example of a PCS communication network of drawing 5 realizes radiocommunication to the low power mobile end user device in the field which a related cel site covers. Each repeater is equipped with the antenna installed in the about 10-meter high for the low power nature of propagation loss and a mobile end user device. These are fully lower than the roof of the building of the perimeter square [in drawing 5] and shown. The field which each cel site covers is restricted by this. Since the field covered by each cel is restricted, in order to cover the whole region everywhere, connection with the base station relevant to the repeater of very many numbers is needed. The capital expenditure needed about this kind of infrastructure is rather difficult for the installation term of PCS service. Probably, the number of PCS subscribers will be unnecessary since it is expected that they are not a large number so much at a service installation stage. [of presenting each cel site / repeater with a network function]

[0026] According to another side face of this invention, two or more repeaters (hereafter called "the repeater in a cluster") in relation to a single hub may be arranged so that it may both function by the "simulcast" method. If it states to a detail and a mobile end user device will transmit a PCS signal, all the repeaters that receive the PCS signal in a cluster will transmit the same PCS signal (or deformation bar SHON of a certain kind) to the hub where it is related through a corresponding radio link (in a cluster). In addition to receiving each bar SHON of a PCS signal from the repeater in a cluster, also in itself [hub], a PCS signal is received from a mobile (setting with role of repeater) end user device. Then, a hub is only added to the PCS signal with which the hub itself received each bar SHON of a common PCS signal (for example, straight-line adder), generates a single combination signal, and sends it out to a base station 520. Or a hub sends out each bar SHON (what the hub itself received is included) of a PCS signal to a base station 520, and performs signal add operation in which the base station 520 was mentioned above. As for the repeater in which it was [in the cluster] different from each other, the case of both sides functions as parts with which the distributed antenna was different from each other. (from a hub to an end user device) About the communication link of hard flow, a hub will broadcast each signal transmission which received from the base station 520 to all addressing to a repeater in a cluster. The advantage of using simulcast is that the fiber interface in

a hub becomes brief. It is because only the signal of one ** needs to arrive at a hub through a fiber. Frequency conversion of the signal which similarly is received by the repeater within the same cluster is carried out to the same frequency as the inside of a hub, it is possible to be mutually added before sending out through a fiber as mentioned above, and the band demand concerning a fiber is reduced. The further advantage of using simulcast is not performing a hand off, when a mobile end user moves between two cels in the same cluster. Still more nearly another advantage of using simulcast is that the range which PCS covers offers the innovative solution about the field where traffic is low in this time which makes it possible to be extended at the expense of min by using the transfer infrastructure by which a reuse may be carried out when a traffic demand increases and network capacity must come to be occupied about the cel site according to individual .

[0027] Although the various modifications of this invention can consider the above explanation about one example of this invention if it is this contractor of this technical field, each of they is included by the technical range of this invention.

[0028]

[Effect of the Invention] the cost which offers the advantage of flexibility which became possible by transparent transport of a spectrum block according to this invention, without needing the cable connection with a base station from each microcell as stated above -- an effective hard flow transmitting system is offered.

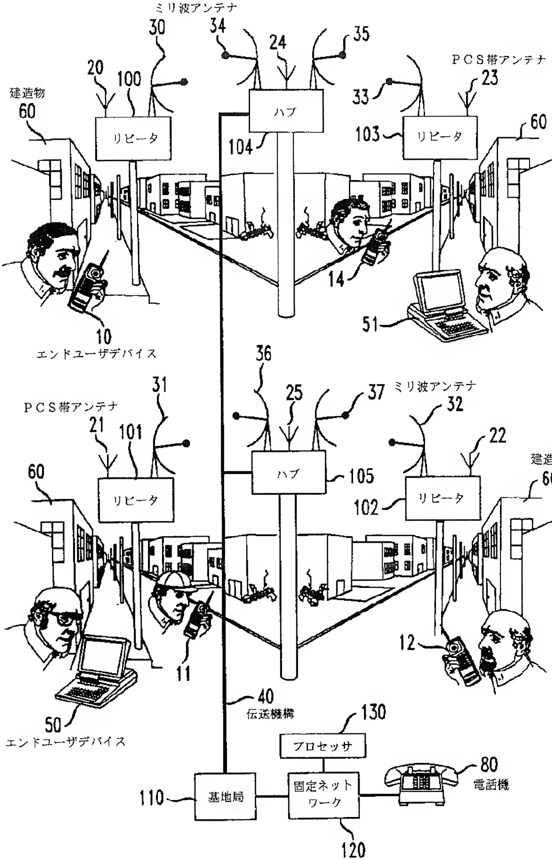
CLAIMS

[Claim(s)]
[Claim 1] In the transmitting system used in a radiocommunication network, here with at least one cluster which consisted of repeaters of A plurality each of said repeater a) the radio signal which generates the signal transmission addressed to the networking device of said communication network from a wireless end user device through a corresponding radio link in order [and] to transmit b radio signal to at least one of said end user devices -- said networking device to an information signal -- receiving -- B -- at least one hub and here Each hub minds the device of the kind a Existing. Said networking device, And the repeater which relates to the cluster of b single, respectively and which is located in said look path of a hub of each, It communicates, respectively. Said communication link with said related repeater The transmitting system characterized by realizing through the corresponding radio link which realizes the communication path which corresponds, respectively between each and said networking device of said related repeater and said hub, and having ** to said signal transmission and said information signal.
[Claim 2] A transmitting system given in the 1st term of a claim characterized by being also the repeater to which said at least one hub communicates with the wireless end user device located near the hub concerned.
[Claim 3] A transmitting system given in the 1st term of a claim characterized by not locating said repeater in a cluster in a look path mutually.
[Claim 4] at least one of said repeaters -- A1 -- with the first signal processor which processes said radio signal received from said wireless end user device, and generates said signal transmission addressed to said networking device The hub which relates to said repeater from the A2i aforementioned networking device is minded. And a transmitting system given in the 1st term of a claim characterized by having the second signal processor which processes the information signal received, respectively from the radio link which carries out the ii aforementioned response in order to output said radio signal to said addressing to an at least one wireless end user device.
[Claim 5] The information signal with which said hub was transmitted to specific one of the repeaters which carry out the A3a aforementioned relation is separated from the signal transmission received by said specific one of said related repeaters. And a transmitting system given in the 1st term of a claim characterized by having at least one duplexer which separates the information signal transmitted to another thing of the repeaters which carry out the b aforementioned relation.
[Claim 6] A transmitting system given in the 1st term of a claim characterized by having a polarization duplexer using the polarization which intersects perpendicularly in order for said at least one hub to relate each signal transmission by which a4 reception was carried out with the specific repeater which transmitted said signal transmission to the hub concerned.
[Claim 7] A transmitting system given in the 1st term of a claim characterized by receiving two or more said radio signals from two or more wireless end user devices on which at least one of said repeaters functions with the different wireless interface, and said at least one repeater receiving said two or more radio signals as the whole block spectrum.
[Claim 8] A transmitting system given in the 1st term of a claim to which said networking device is characterized by being chosen from a base station, b processor, and the device group containing c

wireless private circuit switch (PBX).
[Claim 9] In a radiocommunication network, the radiocommunication network concerned receives at least one radio signal from at least one wireless end user device located near the Aa. b) Said at least one received radio signal is changed into an intermediate frequency. c selection And at least one repeater which carries out the frequency modulation of the carrier transmitted through the radio link which operates in the frequency range carried out with said intermediate frequency signal, Said signal by which frequency modulation was carried out is received through said radio link from said at least one repeater arranged in said at least one look path of a hub. B) -- a -- At least one hub which generates the signal near the baseband to which restored to the signal by which the b aforementioned frequency modulation was carried out, and it restored, and here and said signal near the baseband Then, the radiocommunication network characterized by carrying out a rise convert at the carrier frequency chosen about the communication link to the transceiver which carries out termination of the device connected to the communication link device of said radiocommunication network, and having **.
[Claim 10] a radiocommunication network given in the 9th term of a claim characterized by said radiocommunication network communicating through the radio link where it has said two or more hubs, and that of each of said hub corresponds to two or more repeaters.
[Claim 11] A radiocommunication network given in the 10th term of a claim characterized by said at least one repeater receiving two or more radio signals as the aggregate of block spectrum from two or more wireless end user devices.
[Claim 12] In the transmitting system used in a radiocommunication network the system concerned the hub of A plurality, and here Said signal near the baseband minds the wireless circuit which functions in an after that predetermined frequency range. the networking device which is doing each a relation of said hub to signal transmission -- receiving -- and b --; which changes said signal transmission into the signal near the baseband -- Here with two or more repeaters by which grouping was carried out to B cluster by which frequency modulation is carried out so that it may be transmitted The repeater in said cluster is arranged in the look path of that to which it relates of said hubs. A frequency modulation finishing recovery is carried out and a got over signal is generated. said repeater in a cluster -- a -- said radio link -- minding -- said frequency modulation finishing signal from said related hub -- receiving -- and b -- said -- it corresponds -- here Said got over signal is a transmitting system characterized by carrying out frequency conversion to at least one wireless carrier frequency transmitted to addressing to an at least one wireless end user device located in near which operates with a single or two or more wireless interfaces after that, and having **.
[Claim 13] In the approach of performing a radio intelligence communication link in a radiocommunication network A) The phase of receiving signal transmission in a radio signal and the second frequency range in the first frequency range in at least one repeater from a wireless end user device, B) In order to generate the frequency modulation finishing signal transmitted through the radio link which functions in the second frequency range of a above in said at least one repeater said radio signal And the phase of processing said signal transmission in order to generate said radio signal transmitted to said addressing to a wireless end user device in the first frequency range of b above, C) In the hub arranged in said at least one look path of a repeater a data signal from the networking device of the a aforementioned radiocommunication network And the phase of receiving

said frequency modulation finishing signal from one repeater even if few [b ****], D) In order to generate said signal transmission transmitted to said addressing to at least one repeater through said radio link in said hub said data signal And the correspondence procedure characterized by having the phase of processing said frequency modulation finishing signal to which it restores since it becomes irregular in a predetermined carrier frequency after that for the communication link to the transceiver which carries out termination of the cable device connected to the b aforementioned communication link device.

[Claim 14] In the hub used in a radiocommunication network, the hub concerned receives the signal transmission become irregular as a spectrum block through the radio link which corresponds from the repeater of Aa plurality. b) the information signal received from the networking device of said radiocommunication network the antenna transmitted to said addressing to a repeater through said radio link, and here Said repeater is arranged in the look path of said hub. So that a wireless end user signal may be received from a nearby mobile end user device The first processor which changes the B aforementioned information signal with which the; aforementioned wireless end user signal arranged is processed within said repeater, and said signal transmission become irregular is generated into the format suitable for transmission through said corresponding radio link, C) Here with the second processor which restores to said signal transmission become irregular, and generates the signal near the got over baseband said signal near the got over baseband The radiocommunication network characterized by carrying out frequency conversion to the predetermined carrier frequency for the communication link to the transceiver which carries out termination of the device connected to said networking device after that, and having **.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PCS帯アンテナ
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エンドユーザデバイス
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プロセッサ
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電話機
110
基地局
固定ネットワーク
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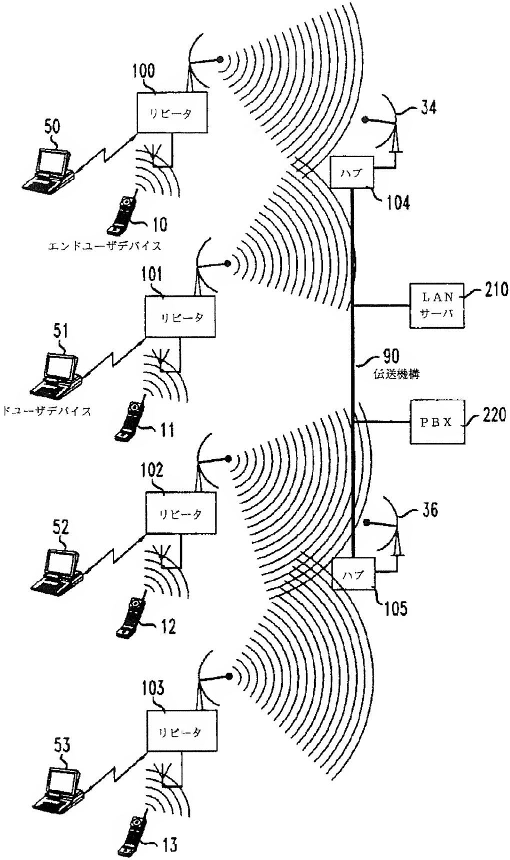
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LAN
サーバ
210
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リピータ
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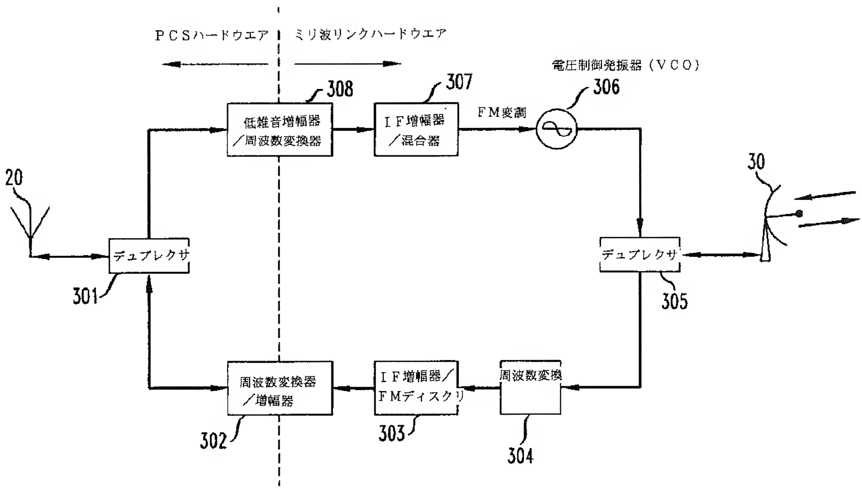

ＰＣＳハードウエア
ミリ波リンクハードウエア
電圧制御発振器（ＶＣＯ）
308
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低雑音増幅器／周波数変換器
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周波数変換器／増幅器
ＩＦ増幅器／ＦＭディスクリ
周波数変換
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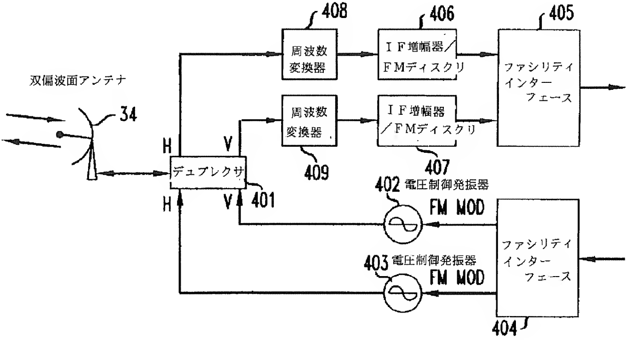

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デュプレクサ
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周波数
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周波数
変換器
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ＩＦ増幅器／
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405
402 電圧制御発振器
FM MOD
403 電圧制御発振器
FM MOD
ファシリティ
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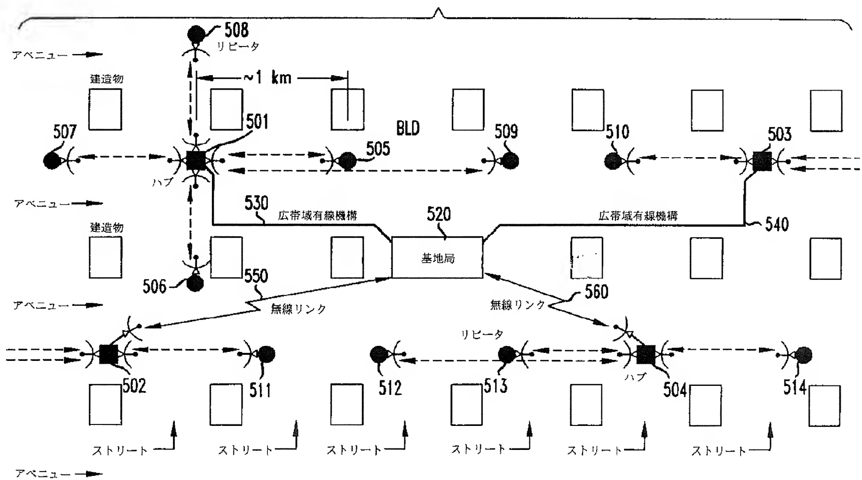
フェース
404


508
リピータ
アベニュー
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建造物
501
BLD
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505
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503
ハブ
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広帯域有線機構
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広帯域有線機構
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無線リンク
リピータ
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